CASE PRESENTATION VV ECMO

Joshua Huelster, MD
Fellow in Critical Care Medicine
Department of Pulmonary and Critical Care Medicine
Hennepin County Medical Center

52-Year-Old Woman

- CC: Cough and dyspnea
- PMHx:
  - Dermatomyositis
  - Obesity
  - Anemia
  - Migraines
- Family Hx:
  - HTN – Father
  - Cancer - Mother
- Social Hx:
  - Married; 4 children
  - Never smoker, no alcohol
  - Originally from Israel
- Allergies: hydrocodone - acetaminophen
- Medications:
  - Prednisone 40 mg daily
  - Methotrexate 15 mg weekly
  - Folic acid 1 mg daily
  - Trazodone 100 mg qHS
  - Omeprazole 40 mg daily
  - Zolpidem 10 mg daily

Admission

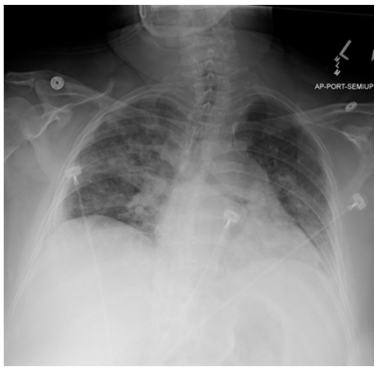
Outside Hospital

HPI:
- Three day history of increasing and progressive dyspnea
- Non-productive cough and fever to 103F
- Recent diagnosis of dermatomyositis
  - On prolonged prednisone taper – current dose 50 mg daily
  - No pneumocystis prophylaxis
  - Started methotrexate 15 mg weekly
  - Seen in Pulmonary clinic for cough – no evidence for ILD

Exam:
- T 103F BP 113/66 HR 110 SpO2 94% (4L NC)
- Gen: mild distress
- CV: tachycardic, regular
- Pulm: diffuse crackles
- Abd: obese, soft
- Skin: no rash
- Neuro: awake and alert

Admission CXR

Bilateral infiltrates – Right greater than left
No pneumothorax
Possible small effusion
Infection most likely



Assessment and Plan

- Likely community acquired pneumonia with sepsis
  - Ceftriaxone and azithromycin
  - Add sulfamethoxazole/trimethoprim due to steroid use and possible pneumocystis jiroveci pneumonia
  - Continue steroids
  - Hold methotrexate
  - Pulmonary consult

Hospital Course

Days 2-8

- Seen by Pulmonary day of admission with plan for bronchoscopy the next day
- Progressed to respiratory failure and intubated with transfer to ICU
  - ABG 7.39/38/96/22.5
  - Vent: PRVC RR18 Vt 500 (10mL/Kg) PEEP 5 FiO2 60%
- Bronchoscopy performed – positive for pneumocystis
  - SMX-TMP continued
  - Steroids continued
  - Other antibiotics stopped
- Continued worsening hypoxia
  - ABG 7.32/46/67/23
  - Vent: PRVC RR 22 Vt 300 (6mL/Kg) PEEP 10 FiO2 100%
  - Flolan and proned
- No improvement with increased PEEP and continued proning
- Transferred to ECMO center hospital day 8

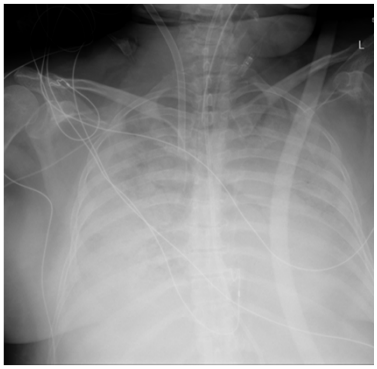
Transfer

- Cannulation and ECMO initiated prior to transfer
  - Seventh day of mechanical ventilation
  - Veno-venous (VV) ECMO
  - 21 French right femoral (drainage) veins and 19 French right internal jugular (return)
  - Uneventful transfer with SpO2 94-100% en route
  - Flow 3.4L/min
  - Transfer vent: RR 10 Vt 300 PEEP 10 FiO2 100%
  - Initial ABG 7.38/44/63/25

ECLS Day 1 CXR

Dense bilateral infiltrates consistent with ARDS

Cannula and ET tube in appropriate position



ECLS Day 1

- VV ECMO
  - RPM 2715
  - Flow 3.4 L/min
  - Sweep 3.5 L/min
- Rest Settings
  - APRV P_{hi} 30 P_{lo} 5 T_{lo} 0.4 sec FiO2 0.45
    - Tidal Volume 300 mL (C_{rs} 12)
  - ABG 7.41/40/90/26

ECLS Day 1

- Acute desaturation during nasogastric feeding tube placement
  - High degree of circuit chatter
  - Decreased flow
  - Cardiac output increased 8.0L/min → 12L/min
  - Placed on emergency vent settings (26/300/10/1.00)
    - Pplat 48
    - No pneumothorax
    - Neuromuscular blockade and esmolol started
- Oxygenation improved (SpO2 85%)
  - Cardiac output decreased to 7.8/min
  - Flow returned to baseline (3.5L/min)
  - Returned to rest settings
    - Vt reduced to 180 mL (C_{rs} 7)

ECLS Day 3

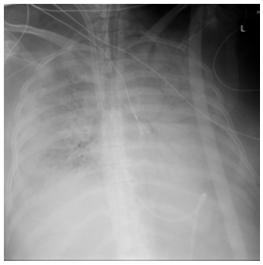
- Attempt made to reduce sedation
  - Increased dyssynchrony with vent
  - Worsened oxygen saturation
  - Did not resolve with increased sedation
  - Neuromuscular blockade resumed
  - ABG 7.45/37/63/26
  - Tidal excursion 90 mL on APRV

ECLS Days 6 - 14

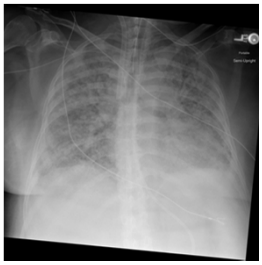
- Tidal excursion had fallen to 62 mL on Day 6
  - Fluid balance net positive 8.5L
  - ECMO flow consistently 3.6-3.8 L/min
  - SpO2 approximately 85%
- Diuresis begun
  - Net negative 3L by Day 14
  - Tidal excursion now 300 mL
  - SpO2 90-92%
  - ABG 7.43/43/55

ECLS Days 6-14

ECLS Day 9



ECLS Day 14



ECLS Day 17

- Changed APRV to PS12 PEEP 14
- Sedation reduced
  - Increased work of breathing
  - Vt 400 with MV 14L
  - Increased sedation without effect
- Changed to PC 20 PEEP 14
  - Paralysis resumed
  - Vt 280 (C_{rs} 14)
- Returned to APRV P_H 24 P_L 10 T_L 0.6

ECLS Days 18 - 30

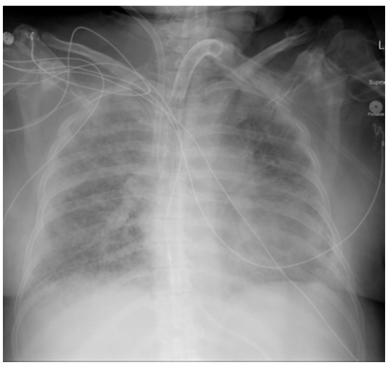
- Repeat bronchoscopies due to increased secretions
  - Periodic, but unsustained improvement in tidal volume
  - Stenotrophomonas maltophilia isolated
    - Treated with moxifloxacin
- Completed PJP treatment
  - Continued on steroids
  - On atovaquone for PJP prophylaxis
    - transient severe leukopenia on TMP – SMX
- Tracheostomy ECLS day 30

ECLS Days 33 - 38

- Progress stalled
- Flolan restarted with improvement in oxygenation
  - PaO2 consistently > 100
  - Remained on rest settings
- Promotion of permissive hypercapnia begun
  - Sweep slowly decreased
  - Goal pCO2 60-70 mmHg
  - Goal HCO3 in mid-30's
- Diuresis held due to new rash and hypotension
  - Net positive 1.6L

ECLS Day 38
CXR

Increase in bilateral infiltrates (R > L)



ECLS Day 39 - 41

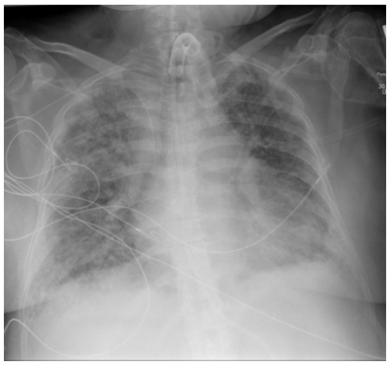
- Diuresis resumed
  - Net negative 1.8L by Day 41
  - Rash stable
- ABG 7.38/68/92/41
  - Sweep at 1
  - Vent PC RR 26 PIP 20 PEEP 14
- Off sweep for 10 hours Day 41
  - Began to stack breaths
  - pCO > 80
  - Sweep resumed

ECLS Day 43

- Sweep off for > 24 hours
  - RPM 3200
  - Flow 2.4L/min
- ABG 7.40/77/138/48
- Vent settings unchanged
  - PC RR 26 PIP 20 PEEP 14
  - Vt 385
- Decannulated

Post ECLS Day 1 CXR

Improving bilateral infiltrates



Post ECLS Course

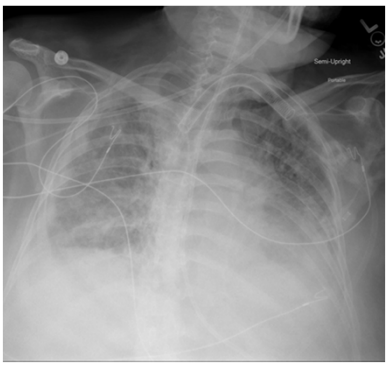
- Febrile after removal of circuit with hypotension
  - Treated empirically for sepsis
  - Negative cultures
  - Tapered off pressors and antibiotics after several days
- Slow weaning of sedation
- Plan for long term acute care hospital (LTACH) once off sedative drips
- However…

Post ECLS Course Day 8

- Significant drop in tidal volumes
- pCO2 increased 7.15/105/133/35
- Changed to VC RR 26 Vt 320 PEEP 7
  - Auto - PEEP 15
  - Pplat 45
  - ABG 7.19/90/133/33
- Restarted neuromuscular blockade
- Bronchoscopy
  - No obstruction of trach or mucus plugging
- Increased steroids
- Aggressive diuresis resumed

Post ECLS Day 8 CXR

Bilateral infiltrates R > L
Bilateral effusions
No pneumothorax



Post ECLS Course Day 9 - 14

- ECMO restart not considered
- Family wished to continue all other aggressive cares
- Slow improvement in lung mechanics
  - Resolution of Auto – PEEP
  - Increased compliance
- Improved gas exchange and compensation
  - Day 10 7.10/108/84/32
  - Day 11 7.17/101/221/35
  - Day 12 7.29/93/112/44
  - Day 13 7.38/82/84/47
  - Day 14 7.41/79/101/49

Post ECLS Days 15 - 26

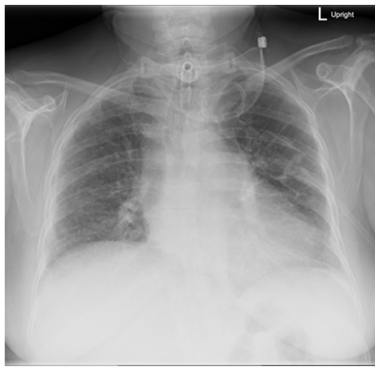
- Continued improvement
- NMB, IV sedation and inhaled epoprostenol discontinued
- Unable to wean from vent
- Transferred to LTACH

Follow Up

- Remained at LTACH for 2.5 months
- Off of ventilator
- Tracheostomy remains
  - Has granulation tissue
  - Treatment ongoing by ENT
- Able to speak
- Using walker
- Now in Transitional Care

Post-DC CXR

Left base atelectasis with bilateral peripheral scarring



Conclusion

- Prolonged VV – ECMO due to PJP pneumonia/ARDS
  - Cannula placed on day 7 of mechanical ventilation
  - Circuit run of 43 days
- Excellent outcome
  - No circuit complications
  - Essentially single organ failure
  - Few serious complications of prolonged critical illness